

FORM PTO-100 (Modified) REV 11-98		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S WORK NUMBER WAT0111	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 09/647670	
INTERNATIONAL APPLICATION NO. PCT/AU99/00237		INTERNATIONAL FILING DATE 30 MARCH 1999 (30/03/99)		PRIORITY DATE CLAIMED 30 MARCH 1998 (30/03/98)	
TITLE OF INVENTION SIDE REINFORCED BULK MATERIAL TRANSPORT CONTAINER					
APPLICANT(S) FOR DO/EO/US KILIAN, Kris et al.					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). 4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c) (2)) <ol style="list-style-type: none"> a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input checked="" type="checkbox"/> A copy of the International Search Report (PCT/ISA/210). 8. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3)) <ol style="list-style-type: none"> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 9. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 10. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)). 11. <input checked="" type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409). 12. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)). 					
Items 13 to 20 below concern document(s) or information included:					
<ol style="list-style-type: none"> 13. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 14. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 15. <input checked="" type="checkbox"/> A FIRST preliminary amendment. 16. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 17. <input type="checkbox"/> A substitute specification. 18. <input type="checkbox"/> A change of power of attorney and/or address letter. 19. <input checked="" type="checkbox"/> Certificate of Mailing by Express Mail 20. <input checked="" type="checkbox"/> Other items or information: 					
Check No. 049140					

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.53) 09/647670	INTERNATIONAL APPLICATION NO. PCT/AU99/00237	ATTORNEY'S DOCKET NUMBER WAT0111
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21. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

- ☒ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **\$970.00**
- ☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **\$840.00**
- ☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **\$690.00**
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **\$670.00**
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **\$96.00**

ENTER APPROPRIATE BASIC FEE AMOUNT =**\$970.00**

Surcharge of **\$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).

\$0.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	31 - 20 =	11	x \$18.00	\$198.00	
Independent claims	2 - 3 =	0	x \$78.00	\$0.00	

Multiple Dependent Claims (check if applicable). ☐**\$0.00****TOTAL OF ABOVE CALCULATIONS =****\$1,168.00**

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable). ☐

\$0.00**SUBTOTAL =****\$1,168.00**

Processing fee of **\$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).

\$0.00**TOTAL NATIONAL FEE =****\$1,168.00**

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). ☐

\$0.00**TOTAL FEES ENCLOSED =****\$1,168.00**

Amount to be: refunded	\$
charged	\$

☒ A check in the amount of **\$1,168.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **02-0385** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

John F. Hoffman
BAKER & DANIELS
111 East Wayne Street, Suite 800
Fort Wayne, Indiana 46802

TX: (219) 424-8000
FAX: (219) 460-1700

SIGNATURE

JOHN F. HOFFMAN

NAME

26,280

REGISTRATION NUMBER

SEPTEMBER 29, 2000

DATE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of)	Group:
Kris Kilian et al.)	
Serial No.)	Examiner:
Filed:)	
Title: SIDE REINFORCED BULK MATERIAL)	
TRANSPORT CONTAINER)	

PRELIMINARY AMENDMENT DELETING
MULTIPLE DEPENDENT CLAIMS

Assistant Commissioner of Patents
 Washington, DC 20231

Sir:

Prior to calculating the filing fee, please enter the following amendments to the application.

IN THE CLAIMS

In claim 4, line 1, delete "or 3".

In claim 5, line 1, delete "any one of claims 2 to 4" and substitute therefor --claim 2--.

In claim 6, line 1, delete "any preceding claim" and substitute therefor --claim 1--.

In claim 7, line 1, delete "any one claims 1 to 5" and substitute therefore --claim 1--.

In claim 8, line 1, delete "or claim 7".

In claim 9, line 1, delete "any one of claims 1 to 5" and substitute therefor --claim 1--.

In claim 10, line 1, delete "any one of claims 1 to 9" and substitute therefore --claim 1--.

In claim 11, line 1, delete "any one of claims 1 to 9" and substitute therefore --claim 1--.

In claim 12, line 1, delete "any one of claims 1 to 9" and substitute therefore -- claim 1--.

In claim 13, line 1, delete "any one of claims 1 to 9" and substitute therefore --claim 1--.

In claim 14, line 1, delete "any preceding claim" and substitute therefore --claim 1--.

In claim 15, line 1, delete "any preceding claim" and substitute therefore --claim 1--.

In claim 16, line 1, delete "one of claims 6 to 15" and substitute therefore --claim 6--.

In claim 17, line 1, delete "any one of claims 6 to 16" and substitute therefore --claim 6--.

In claim 22, line 1, delete "any one of claims 17 to 21" and substitute therefore
 --claim 17--.

09/647670

APPLICANT OR PATENTEE: _____

SERIAL NO. OR PATENT NO. _____ Attorney's Docket No.: _____

FILED OR ISSUED: _____

TITLE: _____

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(b)) - INDEPENDENT INVENTOR

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled: _____ described in:

BULK MATERIAL TRANSPORT CONTAINERS

- ☐ The specification filed herewith
- ☐ Application Serial No. _____, filed _____
- ☐ Patent No. _____, issued _____

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☐ no such person, concern, or organization
- ☐ persons, concerns, or organizations listed below *

* NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities (37 CFR 1.27).

FULL NAME: LYNX ENGINEERING CONSULTANTS PTY LTD.

ADDRESS: Level 2, 76 Kings Park Road, West Perth. W.A. 6005. Australia.

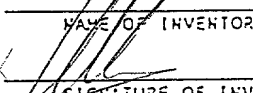
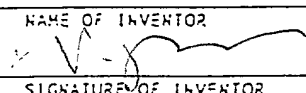
☐ INDIVIDUAL ☒ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

KRIS KILIAN

VLADIMIR MAZUR

NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
		
SIGNATURE OF INVENTOR	SIGNATURE OF INVENTOR	SIGNATURE OF INVENTOR
1-11-2000	01-11-00	
DATE	DATE	DATE

APPLICANT OR PATENTEE: _____ Attorney's Docket No.: _____

SERIAL NO. OR PATENT NO. _____

FILED OR ISSUED: _____

TITLE: _____

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(c)) - SMALL BUSINESS CONCERN

I hereby declare that I am:

☐ the owner of the small business concern identified below:

☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: Lynx Engineering Consultants Pty Ltd.,
ADDRESS OF CONCERN: Level 2, 76 Kings Park Road, West Perth. W.A. 6005. Australia.

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention entitled:

SIDE REINFORCED BULK MATERIAL TRANSPORT CONTAINER

by inventor(s) KRIS KILIAN AND VLADIMIR MAZUR
described in:

☐ the specification filed herewith.

☐ Application Serial No. _____, filed _____.

☐ Patent No. _____, issued _____.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by an concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e). *NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities (37 CFR 1.27).

FULL NAME: _____
ADDRESS: _____

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NON PROFIT ORGANIZATION

FULL NAME: _____
ADDRESS: _____

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NON PROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING: Monica Kilian

TITLE OF PERSON OTHER THAN OWNER: Director

ADDRESS OF PERSON SIGNING: 124 Glenquiff Drive, Floreat WA 6014
Australia

SIGNATURE: [Signature] DATE: 01/11/00

BULK MATERIAL TRANSPORT CONTAINERS

The present invention is related to bulk transport containers, and in particular to containers used in road and rail transportation.

Bulk transport fleet operators presently use containers that are designed
5 inefficiently and are unable to carry more payload than they are designed for without damaging the container, or without significantly affecting the containers safety and fatigue life. If such containers consistently carry more load than they are designed for, then unexpected structural failures are likely, along with a higher risk of derailment in the case of rail transportation.

10 The containers presently used by both Australian and international transportation companies to carry bulk product are based on designs that are at least 20 years old. Each new container that is produced is still based on these old concepts, such that the problems inherent in ageing containers will be duplicated in the new containers. Thus, if operators look to maximise the carrying
15 capacity of their containers by increasing payloads the inherent design problems will be exacerbated.

It is an object of the present invention to provide a container for bulk product transportation that is more efficient and cost effective than existing containers.

20 With the above object in mind the present invention provides a container for transporting bulk material including two side walls, two end walls and a base, wherein at least one said side wall includes at least one ridge running along said at least one side wall between said end walls, and wherein said ridge is integrally formed within said at least one side wall.

25 Preferably, there will be at least one internal ridge between each of the reinforcing members.

Preferably, there will be at least one internal ridge between an end wall and a first reinforcing means.

30 In some instances extra reinforcing members might be required to satisfy the structural strength of any or all panels on the side wall and/or floor and/or end wall.

Ideally, the internal ridge includes a first wall portion angled from the wall towards the interior of the container, and a second wall portion rejoining the first wall portion to the wall. The angle of the first wall portion is in the direction of flow during unloading of the material to be transported.

5 Alternatively, the internal ridge includes a first wall portion deflected inwardly a progressively increased degree relative to the intersection of the side wall and the base, and a second wall portion extending from the first wall portion and being deflected outwardly a progressively decreased degree relative to the intersection of the side wall and the base.

10 The angle of the first wall portion may be determined by subtracting the natural angle of repose of the transported product, from the angle the container is rotated during unloading. Whilst the first and second wall portions may be symmetrical, they may also be of uneven length.

In further embodiments, the internal ridge may also include a third wall
15 portion between the first wall portion and the second wall portion. This third wall portion may be flat or concave. Any such flat third wall portion may additionally be parallel to the side wall.

In some applications, a partial internal ridge may extend along the top edge or rim of the side walls. Such a partial internal ridge may consist of the first
20 wall portion of the internal ridge. In this case an additional strengthening member along the edge or rim of the side wall would be included.

In a preferred embodiment, the base of the container also includes at least one internal ridge extending substantially along the length of the base.

It will be convenient to further describe the invention by reference to the
25 accompanying drawings which illustrate possible embodiments of the invention and improvements over the prior art. Other embodiments of the invention are possible and consequently the particularity of the accompanying drawings is not to be understood as superseding the generality of the preceding description of the present invention.

30 Figure 1 shows an isometric view of a conventional container.

Figure 2a shows an isometric view of one container of the present invention.

Figure 2b shows a similar container to that of Figure 2a with a cutaway portion to better show the internal ridge.

Figure 3a shows an isometric view of a further container of the present invention.

5 Figure 3b shows a similar container to that of Figure 3a with a cutaway portion to better show the internal ridge.

Figure 4a shows a simple cross-sectional view of a conventional container.

10 Figure 4b shows a simple cross-sectional view of a container of the preferred embodiment of the present invention.

Figure 5 shows a cross-sectional view of a container of the present invention superimposed over a conventional container.

Figure 6 shows the arrangement of the internal ridge for a container with a bottom dumping mechanism.

15 Figure 7 shows the angle of repose diagrammatically.

Figure 8 shows an expanded view of an internal ridge of the present invention.

Referring now to Figures 1 and 4a, the shape of a conventional container as presently used can be seen. The basic container includes two side walls 1, a
20 base 2, and two end walls 3. The size of any such container, whether it be for transportation by road or by rail, has certain dimensional limitations. That is, neither the height, nor width, of the container can exceed pre-defined dimensions. These pre-defined dimensions are determined by both rail or road standards, and also, the practical limitations of loading and unloading facilities.

25 Accordingly, whilst it is presently desirable in the industry to increase payloads, the size of the actual containers cannot be increased without decreasing the strength of the containers. In this regard, it is noted that the walls of the containers do not extend to the maximum possible dimensions due to the structural requirements of the container. That is, the bulk product transported via
30 these containers places extreme stresses on the walls of the containers, requiring a number of support or reinforcing members to strengthen the walls. This can conveniently take the form of a number of ribs 4, extending around the

body of the container. The addition of the necessary number of ribs 4 to strengthen the walls 1, result in a much heavier container and in a resultant decrease in the aerodynamics of the container, having both fuel and cost implications on the profitability of the container. It is also noted that structural maintenance and repairs to such containers are both frequent and expensive and do not guarantee that the operational life of the container will be significantly increased.

It will be appreciated that larger containers will require more ribs or reinforcing members. The present invention reduces the number of ribs that is required when compared to a conventional container of equal size.

Referring now to Figures 2, 3 and 4b, the preferred embodiment of the present invention can be seen. The container of the preferred embodiment also includes two side walls 5, two end walls 7, and a base 6. However, the present invention also includes at least one internal ridge 8. The main element of this internal ridge 8, is a first portion 8a, which extends from the wall at an angle towards the interior of the container. A second portion 8b, can be adapted to complete the internal ridge 8, by rejoining the wall 5, to the end of the first portion 8a.

In some circumstances the ridge could be supplemented by extra reinforcing elements to add structural strength if required. That is, dependent on the material to be transported, it may also be desirable to add extra reinforcement to the internal ridge. This extra reinforcement may be added to the internal ridge between each strengthening rib, or alternatively, to the internal ridge in at least one of the wall sections. As seen in Figures 2b and 3b, this reinforcement may be shaped similar to that of the internal ridge.

It is noted that as we move along the first portion 8a from the side wall 5, the angle between the side wall 5 and the position on the first portion 8a relative to the intersection of the side wall 5 and base 6 progressively increases. Similarly, as we return along the second portion 8b, the angle relative to the intersection between the side wall 5 and base 6 progressively decreases.

The angle $\theta 1$ at which the portion 8a, extends from the wall 5 towards the interior of the container is chosen to ensure that the product to be carried by

the container is unloaded completely. That is, the angle is preferably dependent on the type of product carried and on the method the operator uses to unload the product. The dimensions of the internal ridge 8, are further determined as a function of the structural strength required and of the natural angle of repose of the material that is to be transported.

The angle at which the first portion 8a extends towards the interior of the container may preferably be determined by the following mathematical formula:

$$\varnothing 1 \leq \varnothing 2 - \varnothing 3 - 90$$

where

$\varnothing 1$ —is the angle between the vertical wall 5, and the first portion 8a.

$\varnothing 2$ —is the angle the container is rotated in the unloading facility.

$\varnothing 3$ — is the natural angle of repose for the product to be transported.

As seen in Figure 7, the natural angle of repose 13 is dependent on the product 12 desired to be carried, and can be determined by pouring or dropping the material 12 on to a level plain so as to form a substantially conical hill. The angle of repose 13 is then determined as the angle between the horizontal plain 15, and a line extending from the base of the cone to the top of the hill.

In some circumstances, it may be more appropriate to use the following formula:

$$\varnothing 1 \leq \varnothing 2 - \varnothing 3 - \varnothing 4 - 90$$

where

$\varnothing 4$ —is the cohesion of the material to be transported when wet.

For a bottom dumping container 180° has to be added to the volume for $\varnothing 1$. Alternatively, the formula may be amended by changing the -90° to $+90^\circ$.

In a further alternative $\varnothing 2$ for a bottom dumping container may be considered to be 180° .

For a bottom dumping container, the ridge can be configured to extend away from the interior of the container. Such an arrangement will not provide the same increased payload as a ridge which extends towards the interior of the container, but nevertheless, will provide substantial gains in cost reduction of fabrication from conventional containers which merely provide an additional

strengthening member along the exterior of a standard container

Essentially, the shape of the first portion 8a of the internal ridge 8 can be determined on the basis of the natural angle of repose 13 of the material which is to be carried. The second portion 8b will depend on the structural and manufacturing requirements of the container and may be derived from detailed structural analysis of the structural strength and stiffness requirements of the container. Whilst the second portion 8b may have a similar angle and length to the first portion 8a, this is not a requirement of the internal ridge. That is, the second portion 8b may be shaped differently to the first portion 8a, in that it may be curved, or flat. Alternatively, the length of the second portion 8b may be different to that of the first portion 8a, and accordingly the angle of the second portion 8b between the wall 5 and the second portion 8b will be different. The shape of the second portion 8b of the internal ridge 8 will depend on the limitations, such as space constraints, of the container, and on the number of internal ridges 8 in the wall 5, and to some degree on manufacturing facilities. Whereas the first portion 8a is based on the angle of repose 13 as discussed above, the second and possibly third portions 8b, 8c are chosen to complete the internal ridge 8, and fulfil the structural requirements of the container.

The length and shape of the internal ridge 8, will depend on the structural requirements of the side walls 5 and the base 6. It will also depend on the spacing between supporting frame members 9, and the natural angle of repose of the material. As the distance or spacing between the supporting frame members 9 increases, it will be necessary to increase the depth 16 of the internal ridge 8, to ensure the necessary structural strength. Accordingly, it is possible to design a container specifically for a certain type of material to be transported, by considering the mass of the material and the pressure the material will place on the walls of the container.

A container constructed with an internal ridge of the present invention provides a container that is able to transport bulk product. Furthermore, the internal ridge acts as an in-built longitudinal structural stiffener. This internal ridge, then ensures that the structural requirements, such as strength, fatigue resistance, and buckling capacity, are met, while ensuring that more product can be loaded into a container that has the same exterior dimensions as a

conventionally designed container. This difference in carrying capacity can be seen in Figure 5, where the shape of a new container of the present invention is superimposed over a conventional container. The shaded area of Figure 5 shows the extra volume that may be loaded into the new container of the present invention.

The internal ridge 8 is designed to run along the length of the side wall 5 between the supporting frame members 9. Depending on the requirements of the container, for example the placement of locking members 16, the shape and design of the internal ridges 8 may vary between the supporting frame members 9, as seen in Figure 2a. Alternatively, as shown in Figure 3a the internal ridge 8 may be consistent in each panel of the side wall 5.

As can be seen from the figures, it is also preferable to include a partial internal ridge 10 at the top of the container. This partial internal ridge 10 may be formed by a first portion which extends at an angle towards the interior of the container. That is, the partial internal ridge 10 does not include the second portion of the internal ridge 8. Ideally, such a partial internal ridge 10 would also include an additional strengthening member 11 which forms the rim of the container. This rim 11 effectively compensates for the omission of the second portion of the internal ridge, thereby ensuring that the structural strength is sufficient. It will be understood that finite element analysis or other structural analysis can be used to determine the depth of the internal ridge and the thickness of the material to be used for the side wall of the container. Again the depth may be calculated depending on the spacing of the supporting frame members 9, and on the pressure exerted by the material to be carried. The exact figure is derived by applying strength of material theory as well as theories of structural mechanics.

The number and the placement of the internal ridges may be dependent upon the size of the container. As can be seen by a comparison of Figures 1 and 2, the addition of the internal ridge 8 reduces the number of strengthening ribs 4 required on a conventional container. This reduction in the number of ribs decreases the weight of the container, and also improves the aerodynamics of the container. Both these features result in a more cost effective container.

The internal ridge 8 may also include a third portion 8c which joins the first

portion 8a to the second portion 8b. This third portion 8c may be used to further improve the structural requirements of the internal ridge 8. Accordingly, depending upon the application, this third portion 8c may be flat or concave. Further, it may run parallel to the wall 5, or extend at some angle relative to the wall 5. Generally, the longer the third portion 8c is, the stronger the internal ridge 8 is. However, if the third portion 8c is longer than the first portion 8a then some structural strength is lost, and accordingly it is desirable that the third portion 8c not exceed the length of the first portion 8a. Whether a third portion 8c is adopted will again depend on the required strength of the structure as well as any space constraints on the container.

The container of the present invention may be used for bulk transportation by either road or rail. It may also be adapted to be used on containers designed for rotary dumping or tipping, or for bottom dumping. The orientation of the internal ridge will depend upon this unloading method. That is, the first portion 8a is always aligned with the flow of the product being unloaded so as to ensure that no product gets caught up inside the container. If the angle of the internal ridge is not designed so as to ensure that all the product was unloaded, it would be possible for trapped product to unbalance a container thought to be unloaded, thereby possibly causing derailment or collapsing of the container. It will also be understood that the base 6 of the container may also include at least one internal ridge, thereby strengthening the base of the container. The internal ridges running along the base of the container, may go over the wheels and extend through substantially the entire length of the container. Such floor ridges can be constructed having two main functions. One being operational, to bridge over the wheel thereby adding greater interior volume, and secondly structural as the ridge is again designed to provide structural strength. The parameters of the floor ridge are established using structural analysis. The height of the floor ridge is a function of the depth of the container, of the material properties of the product carried, and of the size of the wheels. The dimensions of the floor ridge will also depend on the spacing of the supporting members.

By the addition of at least one internal ridge in the wall of the container, the present invention results in a container that is lighter than conventional containers as the side wall containing the internal ridge does not require as many structural

reinforcements as conventional containers, since the internal ridge itself adds to the structural strength of the wall. Again this can be seen by comparison of Figures 1 and 2, whereby the number of ribs or strengthening elements is less than in the original design. The decrease in the number of ribs 9 also leads to a cheaper container. The decrease in the number of vertical elements, and protruding parts generally improves the aerodynamic shape of the container, thereby making a more efficient and economical container. Further, because fewer welds are required the design ensures that there are fewer areas of stress concentration, thereby making the improved container more fatigue resistant.

As an example of the present invention, for a container designed to carry bulk ore from Mt Whaleback in Western Australia, the overall dimensions of the container could be:

Length = 9.068 metres

Breadth = 3.200 metres

Depth = 2.278 metres

As to the ridge, assuming that the iron ore has a bulk density of 27.1 KN/m³, an angle of repose of 35° and a side rotation of 137° for unloading, then the internal ridge characteristics could be as follows:

Ø1, the angle between the vertical wall 5 and the first portion of the ridge 8a, is calculated at 12°. Structural analysis has determined that the first internal ridge portion 8a ideally starts at a vertical height of 350mm from the base; is angled inwards at 10 degrees (which is less than the calculated 12° to account for any adhesion of the material) and continues inwards until it reaches a vertical height of 800mm from the base, which is equivalent to a 75mm internal ridge depth. A third portion 8c is required of 95mm vertical height and the second portion 8b joins the third portion 8c, to the vertical wall 5, finishing at an overall height of the completed ridge 1040mm from the base.

Ideally, in the longest wall section an extra reinforcing member would also be added to the internal ridge to provide structural strength.

The main benefits of this design compared to existing bulk iron ore containers carrying the same stated ore are that the overall weight of the container is reduced by approximately 18% due to the improved structural efficiencies gained from the new structural wall and floor shape. Further, the

payload of the improved container is increased by approximately 1% over that of a conventional container due to the increase in the container volume.

In addition, the aerodynamic characteristics of the shape reduce the drag coefficient on the side walls by 19% which will result in improved fuel economy for the operator.

In summary, the present invention provides a container that fits into the prescribed parameters, such as the maximum dimensional requirements, but still allows for an increased payload capacity without sacrificing structural strength. The more efficient structural design means that the container is lighter and more aerodynamic. Furthermore, the shape of the container is such that the product unloads easily and no product is left in the container after unloading operations. The angle and shape of the side walls and internal ridge are designed to take into consideration the products natural repose angle as well as the operators loading methodology, thereby ensuring that efficient unloading is achieved.

Variable	Mean	SD	Min	Max
Age	35.2	12.5	18	65
Gender	0.45	0.50	0	1
Marital status	0.60	0.49	0	1
Education	12.5	2.1	9	16
Income	3500	1500	1000	8000
Health status	0.75	0.43	0	1
Employment	0.80	0.41	0	1
Home ownership	0.65	0.48	0	1
Vehicle ownership	0.55	0.50	0	1
Life satisfaction	4.2	1.5	1	7
Health satisfaction	4.5	1.6	1	7
Financial satisfaction	4.0	1.4	1	7
Relationship satisfaction	4.3	1.5	1	7
Community satisfaction	4.1	1.4	1	7
Overall life satisfaction	4.3	1.5	1	7

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wall portion is in the direction of flow during unloading of the material to be transported.

9. A container as claimed in any one of claims 1 to 5, wherein said internal ridge includes a first wall portion deflected inwardly a progressively increased degree relative to the intersection of said side wall and said base, and a second wall portion extending from said first wall portion and being deflected outwardly a progressively decreased degree relative to the intersection of said side wall and said base.

10. A container as claimed in any one of claims 1 to 9 wherein said first wall portion extends from said side wall at an angle $\emptyset 1$, wherein:

$$\emptyset 1 \leq \emptyset 2 - \emptyset 3 - 90^\circ$$

where:

$\emptyset 1$ - is the angle between said side wall and said first wall portion,

$\emptyset 2$ - is the angle said container is rotated during unloading of said container, and

$\emptyset 3$ - is the natural angle of repose of material to be transported in said container.

11. A container as claimed in any one of claims 1 to 9 wherein said first wall portion extends from said side wall at an angle $\emptyset 1$, wherein:

$$\emptyset 1 \leq \emptyset 2 - \emptyset 3 - \emptyset 4 - 90^\circ$$

where:

$\emptyset 1$ - is the angle between said side wall and said first wall portion,

$\emptyset 2$ - is the angle said container is rotated during unloading of said container,

$\emptyset 3$ - is the natural angle of repose of material to be transported in said container, and

$\emptyset 4$ - is the cohesion of said material to be transported when wet.

12. A container as claimed in any one of claims 1 to 9 adapted for unloading of material through the base of the container, and wherein said first wall portion extends from said side wall at an angle $\varnothing 1$, wherein:

$$\varnothing 1 \leq 90^\circ - \varnothing 3$$

where:

$\varnothing 1$ - is the angle between said side wall and said first wall portion, and

$\varnothing 3$ - is the natural angle of repose of material to be transported in said container.

13. A container as claimed in any one of claims 1 to 9 adapted for unloading of material through the base of the container, and wherein said first wall portion extends from said side wall at an angle $\varnothing 1$, wherein:

$$\varnothing 1 \leq 90^\circ - \varnothing 3 - \varnothing 4$$

where:

$\varnothing 1$ - is the angle between said side wall and said first wall portion,

$\varnothing 3$ - is the natural angle of repose of material to be transported in said container, and

$\varnothing 4$ - is the cohesion of said material to be transported when wet.

14. A container as claimed in any preceding claim wherein said first and second wall portions are symmetrical.

15. A container as claimed in any preceding claim wherein said second wall portion is convex or concave.

16. A container as claimed in one of claims 6 to 15, wherein said first wall portion is aligned with the flow of material during unloading of said container.

17. A container as claimed in any one of claims 6 to 16, wherein said ridge further includes a third wall portion between said first wall portion and said second wall portion.

18. A container as claimed in claim 17 wherein said third wall portion is concave.

19. A container as claimed in claim 17 wherein said third wall portion is flat or straight.

20. A container as claimed in claim 19 wherein said third wall portion is parallel to said side wall.

21. A container as claimed in claim 19 wherein said third wall portion is angled relative to said side wall.

22. A container as claimed in any one of claims 17 to 21 wherein said first wall portion is equal to or longer than said third wall portion.

23. A container as claimed in any one of claims 6 to 22, wherein at least one said side wall further includes a partial ridge along the top or rim of said at least one side wall, said partial ridge being formed by a fourth wall portion, said fourth wall portion being equivalent to said first wall portion.

24. A container as claimed in claim 23, wherein said fourth wall portion is of equal length to said first wall portion.

25. A container as claimed in claim 23 or 24 wherein said partial ridge further includes a strengthening member along the periphery of said fourth wall portion, said strengthening member forming the rim of said container.

26. A container as claimed in claim 25, wherein said strengthening member is integrally formed within said at least one side wall.

27. A container as claimed in any preceding claim wherein said base of said container includes at least one ridge extending substantially along the length of said base.

28. A container as claimed in claim 27 wherein said at least one ridge along said base is located about wheel or track positions of a support for said container.

29. A container substantially as hereinbefore described with reference to figures 2a, 2b, 3a, 3b, 4b, 6 or 8.

30. A container as claimed in any preceding claim for use in transportation of bulk material by road.

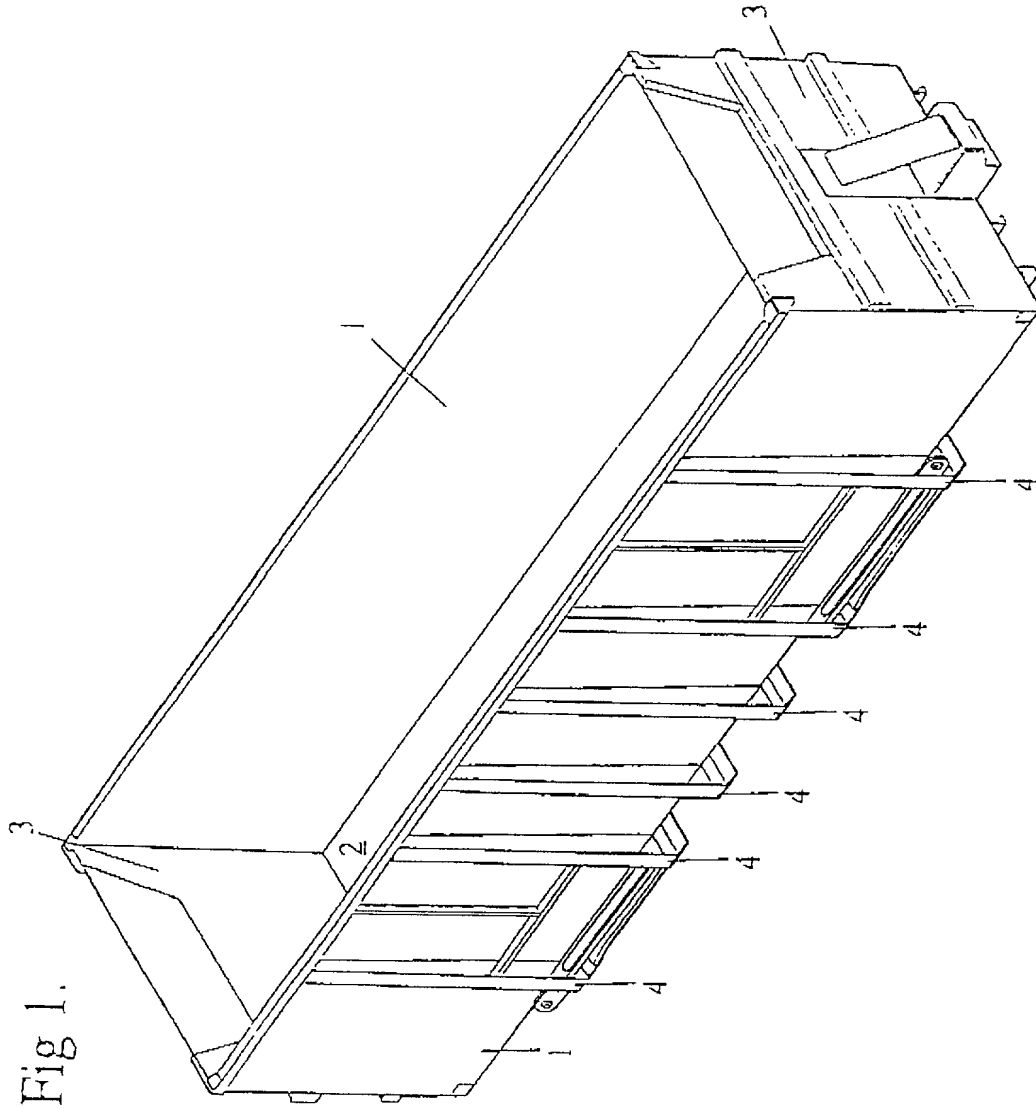
31. A container as claimed in any preceding claim for use in transportation of bulk material by rail.

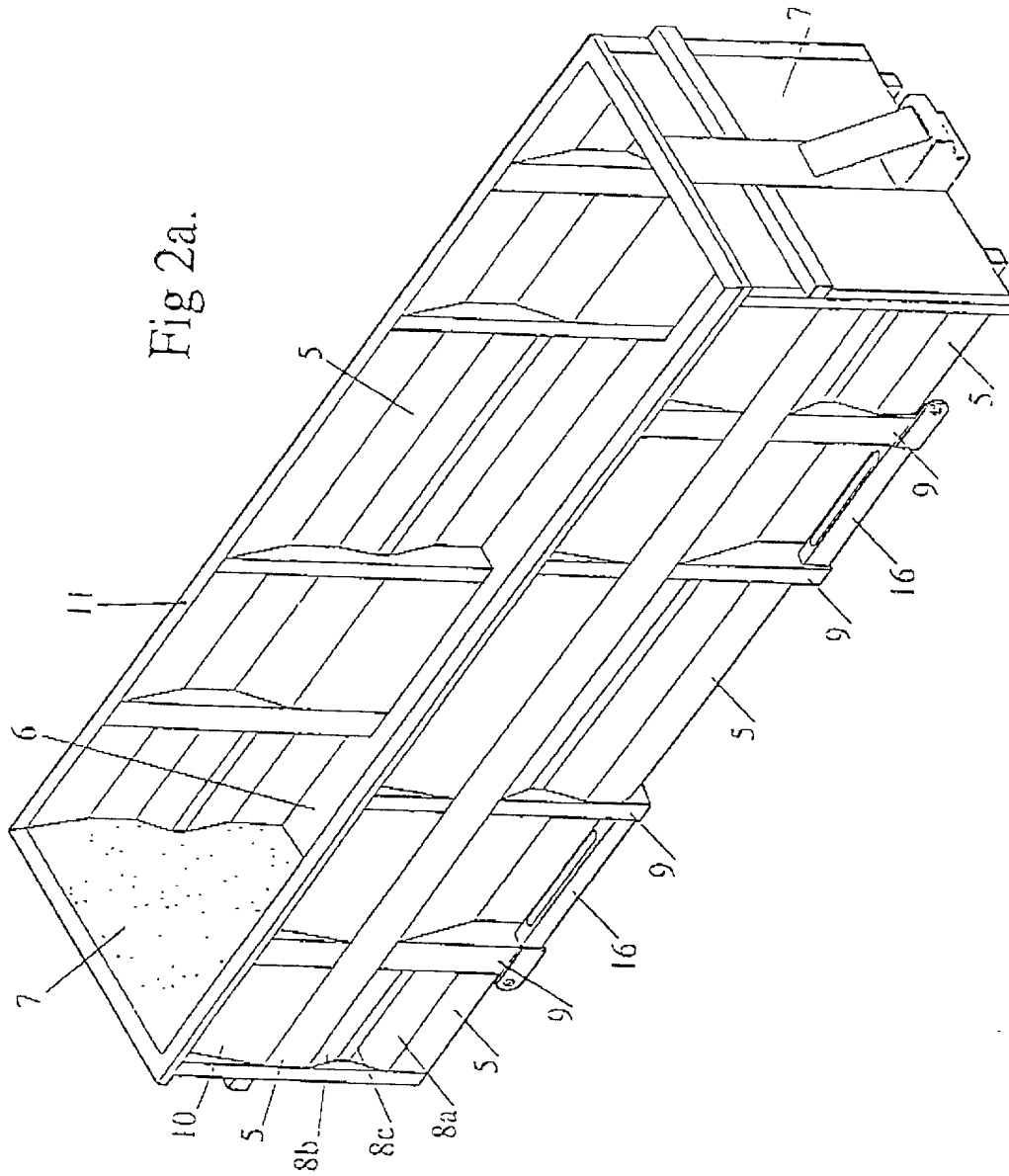
ABSTRACT

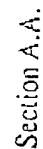
A container for transporting bulk material including two side walls, two end walls, and a base; the side walls including a plurality of vertical reinforcing members spaced along the length of the side wall, wherein the side wall between at least one adjacent pair of the reinforcing members includes at least one internal ridge running therebetween.

[illegible]

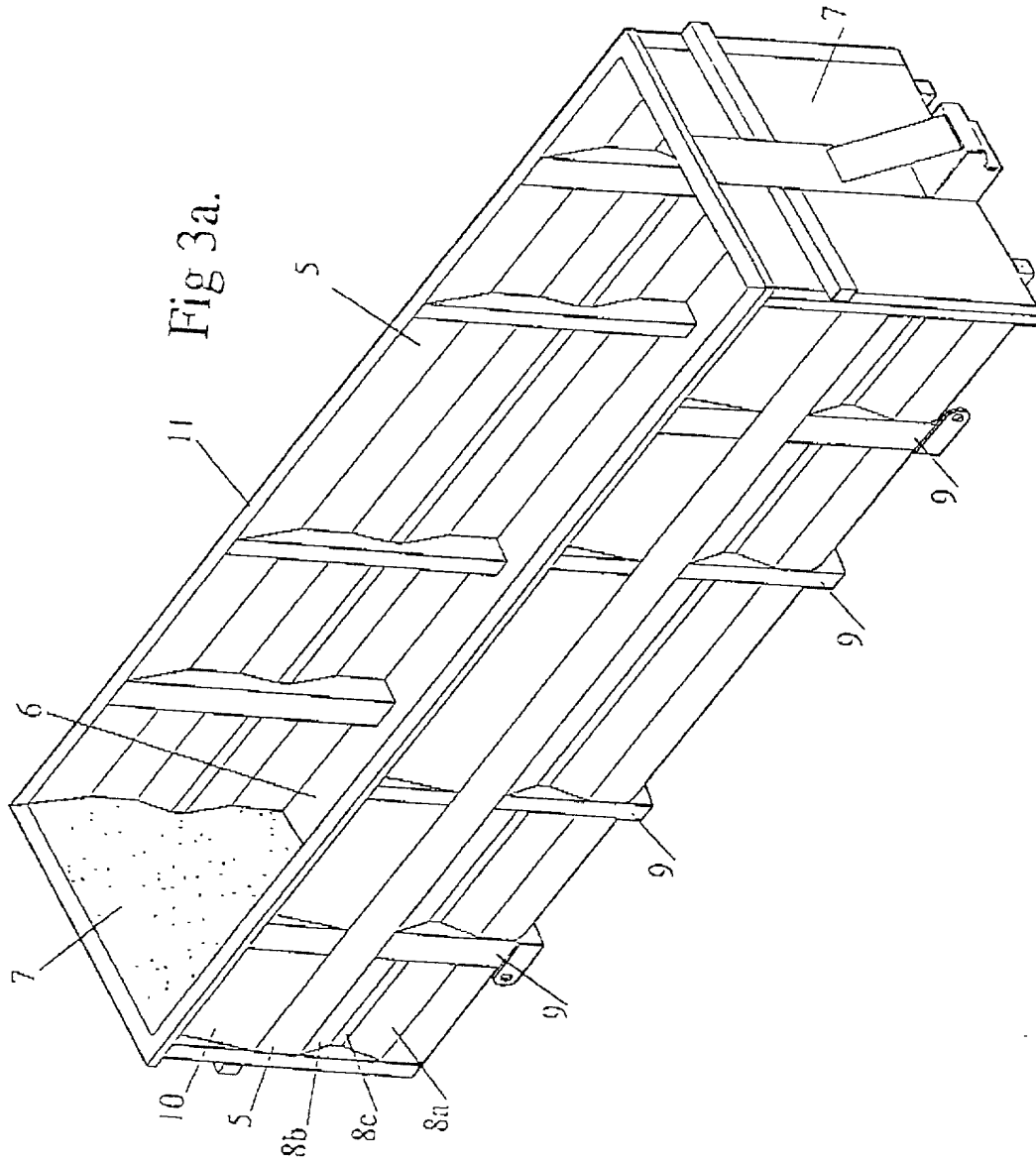
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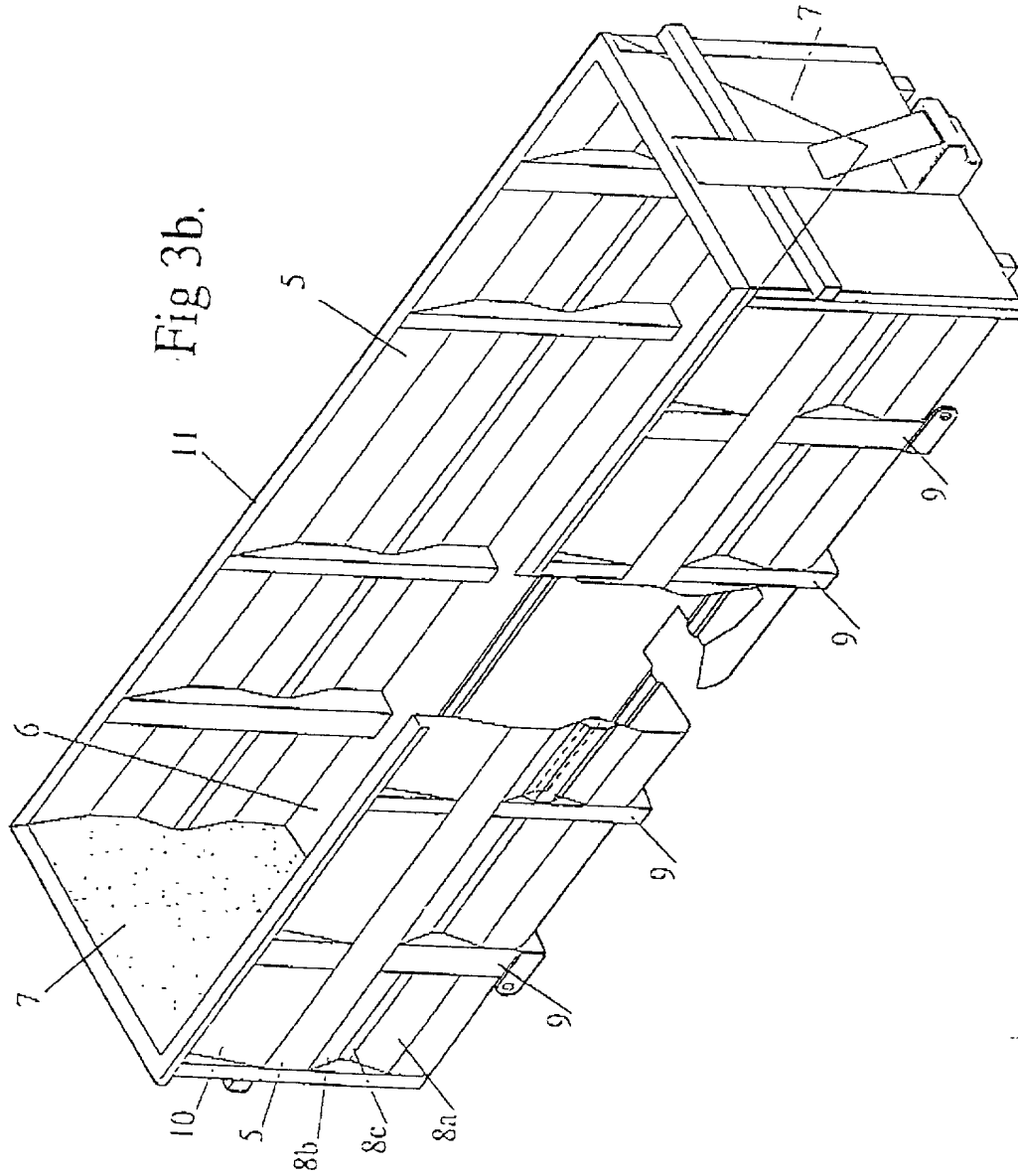


Fig 4a.

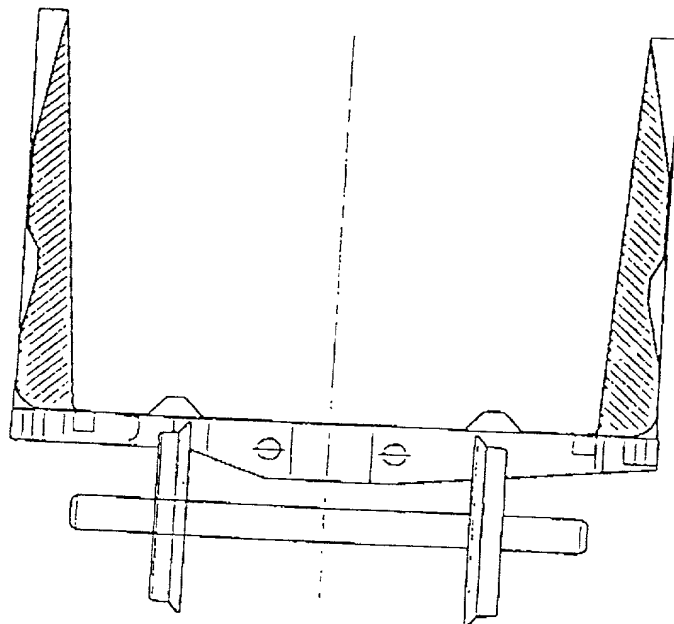
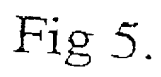
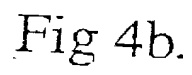


Fig 6.

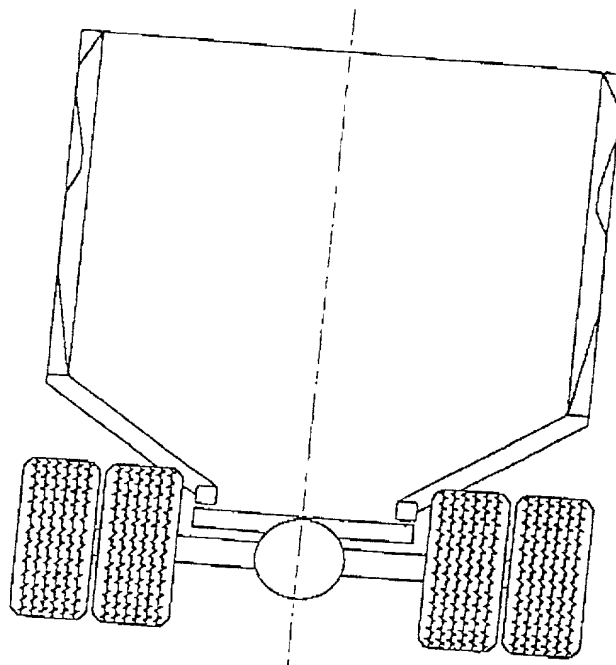


Fig 7.

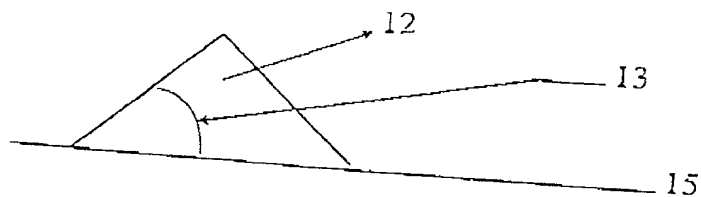
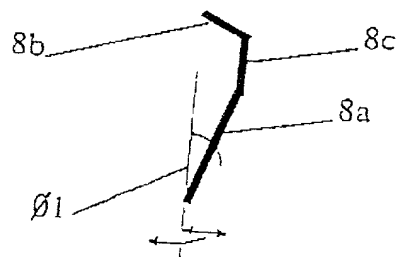


Fig 8.



As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name:

SIDE REINFORCED BULK MATERIAL TRANSPORT CONTAINER

[] is attached hereto.

[*] was filed on March 30, 1999 as
International Application Serial No PCT/AU99/00237
and was amended on _____.
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

Priority Claimed

PP 2677	Australia	30 March 1998	[x] []
(Number)	(Country)	(Day/Month/Year Filed)	Yes No
			[] []
(Number)	(Country)	(Day/Month/Year Filed)	Yes No

I hereby claim the benefit under Title 35, United States Code, §120, of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56, which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.)	(Filing Date)	(Status)(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements

and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

As a named inventor, I hereby appoint John F. Hoffman, Regis. No. 26,280; Anthony Niewyk, Regis. No. 24,871; Kevin R. Erdman, Regis. No. 33,687; Brian C. Pauls, Regis. No. 40,122; Michael D. Smith, Regis. No. 50,181; Arthur R. Whale, Regis. No. 18,778; Lawrence A. Steward, Regis. No. 32,309; Edward J. Prein, Regis. No. 37,212; James D. Hall, Regis. No. 24,893 and Ken C. Decker, Regis. No. 25,422; of BAKER & DANIELS, as attorney(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

The undersigned hereby authorizes the U.S. attorney or agent named herein to accept and follow instructions from Watermark as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney or agent and the undersigned. In the event of a change in the persons from who instructions may be taken, the U.S. attorney or agent named herein will be so notified by the undersigned.

SEND CORRESPONDENCE TO:

DIRECT TELEPHONE CALLS TO:

John F. Hoffman
BAKER & DANIELS
111 East Wayne Street, Suite 800
Fort Wayne, IN 46802

John F. Hoffman
Telephone: 219-424-8000
Facsimile: 219-460-1700

Full name of sole or first inventor: Kris Kilian

Residence: Floreat. W.A. Australia ~~AUS~~ Citizenship Australia

Post Office Address 24 Glengriff Road, Floreat. W.A. 6014. Australia.

Inventor's Signature [Signature]

Date 11-11-2000

Full name of second joint inventor: Vladimir Mazur

Residence Floreat. W.A. Australia ~~AUS~~ Citizenship Australian

Post Office Address 9 North Banff Road, Floreat. W.A. 6014. Australia.

Inventor's Signature [Signature]

Date 01-11-00

Full name of third joint inventor: _____

Residence _____ Citizenship _____

Post Office Address _____

Inventor's Signature _____

Date _____

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